FIRST QUARTERLY PROGRESS REPORT

FOR

SOLID-STATE RF GENERATOR

31 May 1963 - 31 August 1963

Contract NObsr-89356

Project Serial No. SR008-03-01

Task No. 9391

NAVY DEPARTMENT

BUREAU OF SHIPS

ELECTRONICS DIVISION

423933

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# SOLID-STATE RF GENERATOR

This Report Covers the Period 31 May 1963 - 31 August 1963

MICROWAVE ASSOCIATES, INC.

BURLINGTON, MASSACHUSETTS

NAVY DEPARTMENT BUREAU OF SHIPS ELECTRONICS DIVISION

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## DETAILED FACTUAL DATA

In the first monthly report, we discussed relative advantages and disadvantages of high power oscillators and low power oscillators from an overall noise and stability standpoint. Further investigation has revealed certain practical limitations which can be summarized by the following generalized boundary conditions.

All oscillators, both high power and low power, require a high-Q resonant circuit to control the frequency; this implies a high voltage. High power oscillators, in addition, also require to operate at high voltage because of the voltage rating of the available transistors. High voltage operation of the oscillators implies high rf voltages across the variable reactance diode which is used for tuning purposes.

In Figure (1), the circuitry is represented by the negative resistance-box feeding the paralled tuned circuit C and L with the diode D, placed in parallel with the tuned circuit. It is possible, by transforming the impedance of the parallel tuned circuit, to reduce the rf voltage across the diode. This is shown in Figure (2). However, the diode is now required to provide a greater change of reactance to effect the same frequency change as in the first condition. Practical limitations of the diodes place a limit on the transformation ratio which can be used. Because of the preceding practical limitations on high power oscillators, our major design emphasis has been applied to stable low power oscillators.

Figure (3) is a schematic of one of the oscillators presently under development. The circuit is a modification of the colpitts configuration. The transistor VT1 is working under defined DC conditions, the base potential being set by the resistors R1 and R2 and the emitter current by resistor R3. The capacitor C1 decouples the base at the oscillation frequency. The radio frequency transformer T1 and the capacitors, C3, C4, the output capacity of the transistor, the circuit stray capacity and the capacity of the diode D1 define the oscillation frequency. The capacitor C5 is to couple the diode to the oscillatory circuit and simultaneously provide DC isolation of the diode control voltage. The decoupling network L1-C6 prevents radio frequency energy from getting back into the controlling source. The capacitors, C3 and C4, provide the feedback network for coupling energy back from the collector circuit to the emitter of the transistor. The capacity ratio of these two condensers are a function of the gain of the transistor, at the frequency of oscillation, and the DC working conditions. The capacitor, C2, is to decouple the HT supply to the u unit and so provide a low impedance radio frequency path for the circulating current in the tank circuit.

The output power of this oscillator is approximately 50 milliwatts and will be fed in an appropriate buffer which will provide sufficient isolation to maintain a stability better than one part in ten thousand. The turns ratio of transformer T1 is such that the load impedance, (that is, the input impedance of the buffer amplifier) is transformed to an optimum value at the collector of transistor T1. This matches the DC condition of the oscillator over the required bandwidth. The amplitude of the oscillatory voltage at the collector is dependent upon the voltage of the HT supply.

## PART II

## PROGRAM FOR NEXT INTERVAL

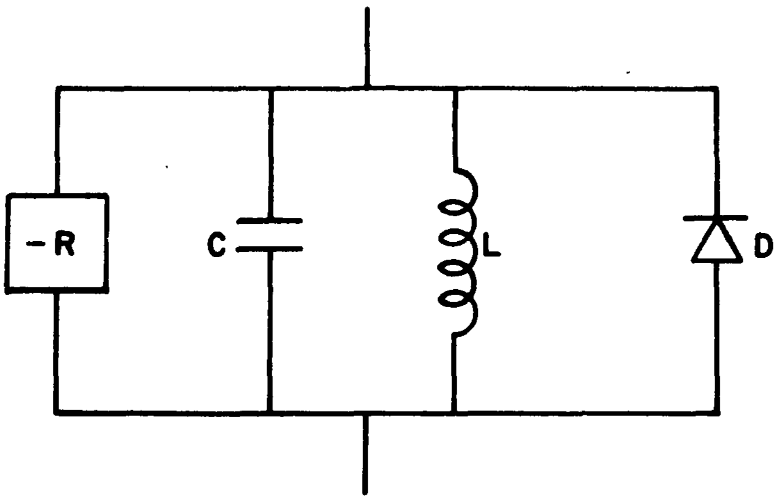
The program for the immediate future will be:

a. Development of a voltage tuned oscillator having a linear relationship between the applied voltage and the frequency deviation.

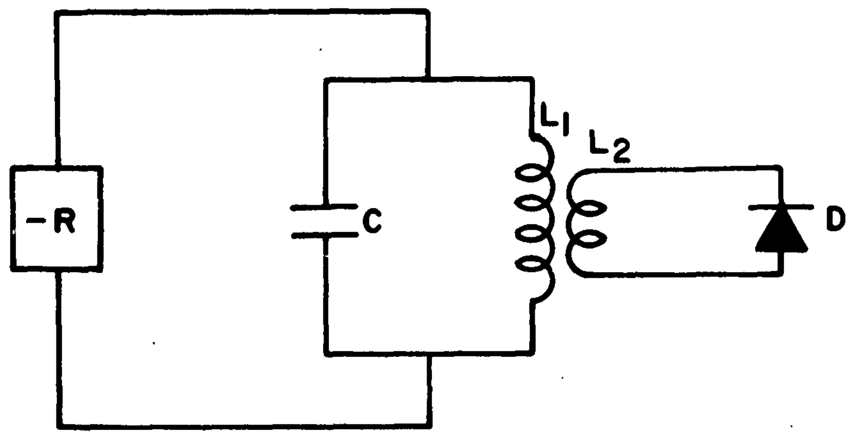
b. Temperature of the voltage tunable oscillator to give maximum frequency stability over a wide temperature range.

## PART III

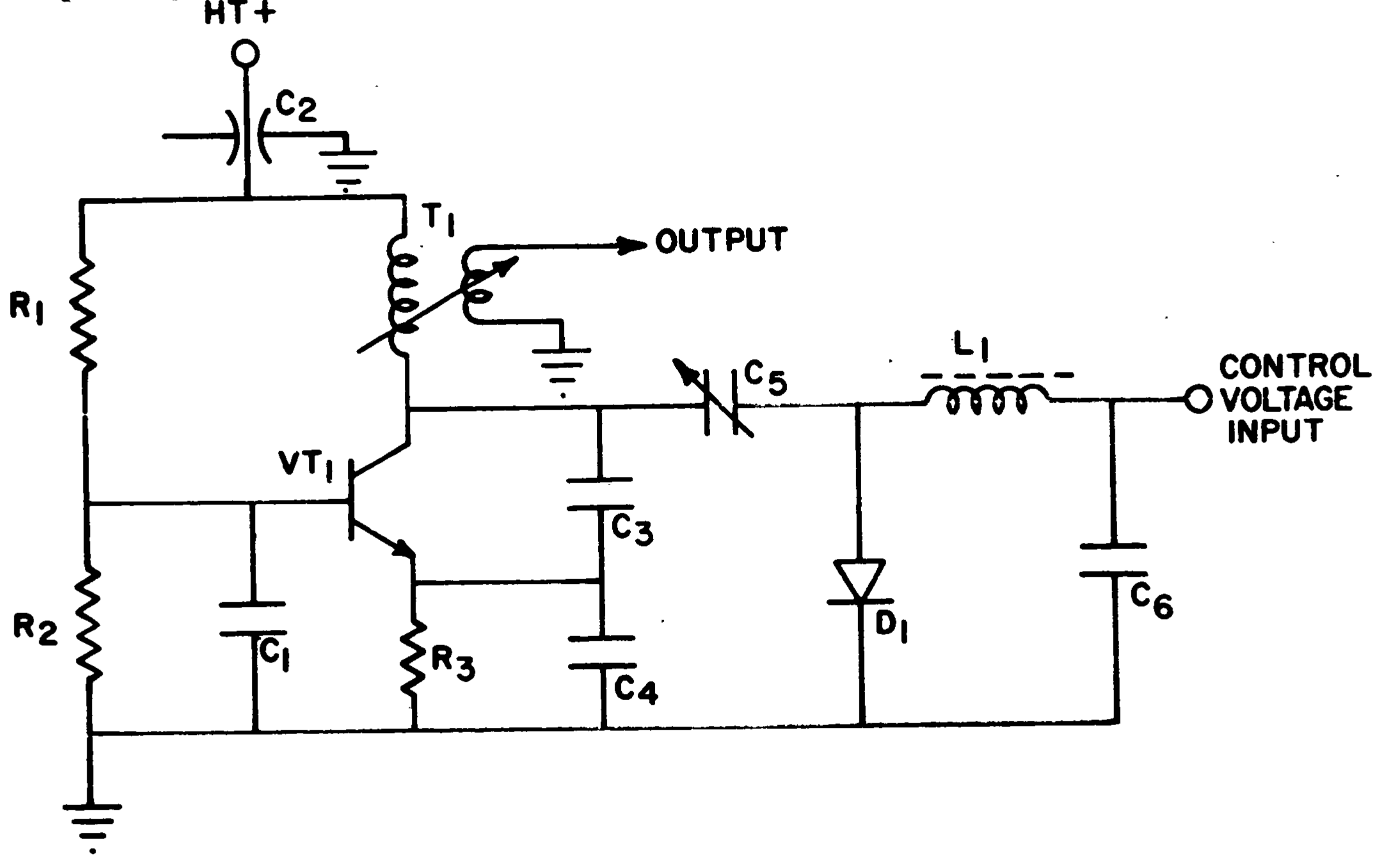
## LIST OF ILLUSTRATIONS




BASIC VOLTAGE TUNED OSCILLATOR
FIGURE 1




MODIFIED VOLTAGE TUNED OSCILLATOR
FIGURE 2




CIRCUIT DIAGRAM OF VOLTAGE TUNED OSCILLATOR
FIGURE 3